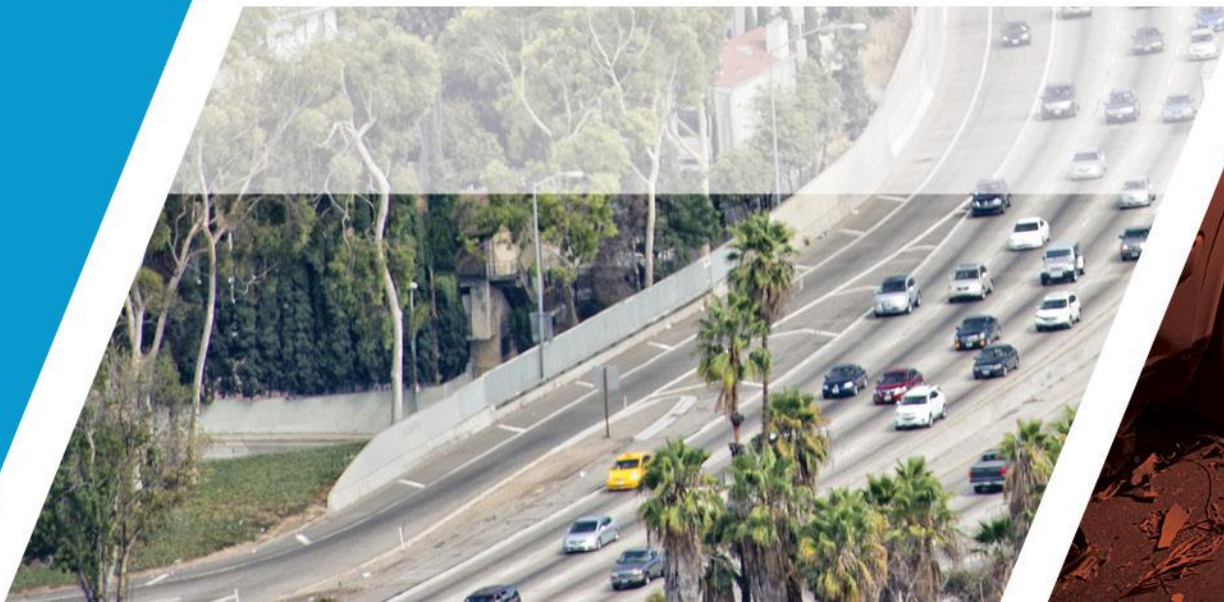




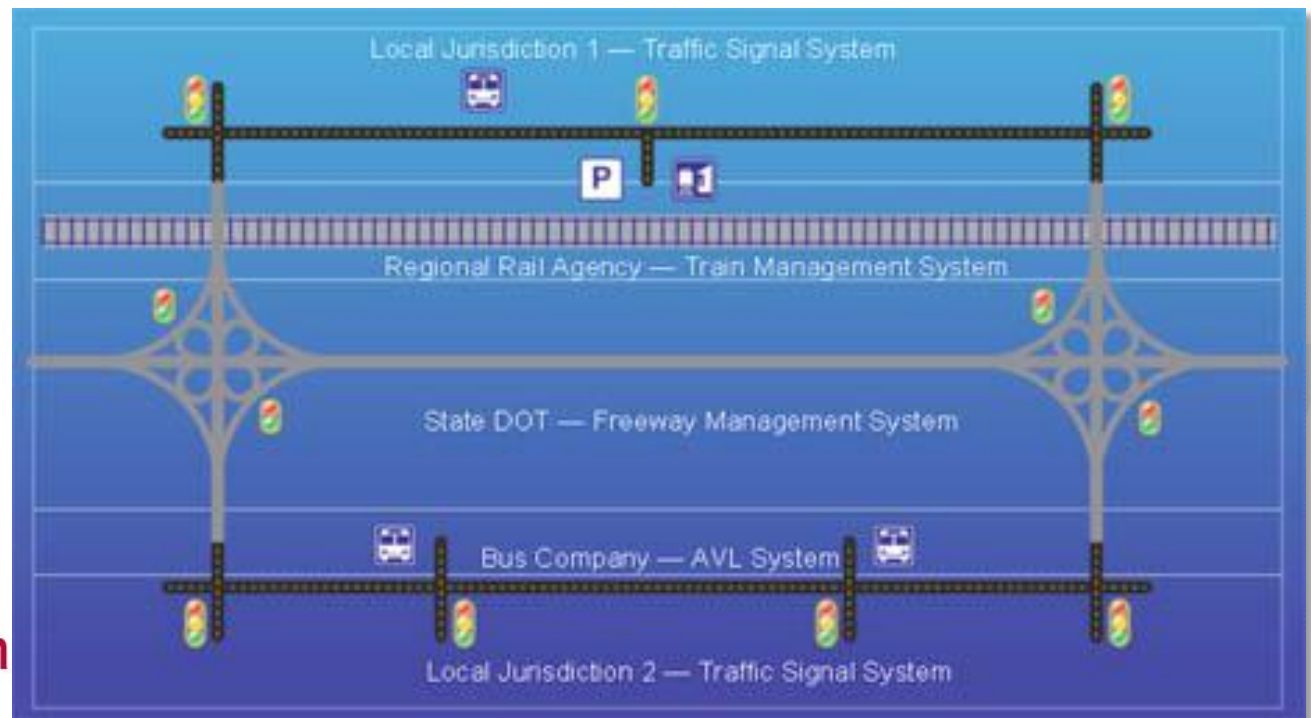
CALTRANS SUBREGIONAL OPERATIONS FORUMS



What Is a Corridor?

“A broad geographical band that follows a general directional flow connecting major sources of trips that may contain a number of streets, highways and transit route alignments.”

From “Glossary of Regional Transportation Systems Management and Operations Terms” (TRB Circular)





How Travelers Use a Corridor

- Travelers view the transportation network as a whole
- When faced with congestion on one facility, travelers may respond by
 - ↳ Selecting a different facility (transit or roadway),
 - ↳ Adjusting their trip to another time of day, or
 - ↳ Remaining on their current route
- Should we manage the corridor to reflect how travelers use it?



Corridor Management

- ▶ Corridors offer opportunities to operate and optimize the entire system
 - ↳ Beyond individual networks
- ▶ Transportation corridors often contain unused capacity
 - ↳ Parallel routes
 - ↳ Non-peak direction
 - ↳ Single-occupant vehicles
 - ↳ Underutilized transit services
- ▶ Managing the corridor can more fully utilize this capacity
 - ↳ Management approaches like ramp metering
 - ↳ Traveler information and outreach



Examples of Corridor Management Components

- ▶ ***Active Traffic Management (ATM)***
- ▶ ***Managed Lanes***
- ▶ ***Integrated Corridor Management (ICM)***
- ▶ Arterial management
- ▶ Bus Rapid transit
- ▶ Real-Time Traveler Information





Active Traffic Management



What Is Active Traffic Management?

Traffic management concepts intended to:

- ▶ Enhance roadway safety
- ▶ Reduce congestion
- ▶ Provide reliable trips
- ▶ Provide enhanced information to motorists
- ▶ Leverage available capacity during periods of congestion or incidents



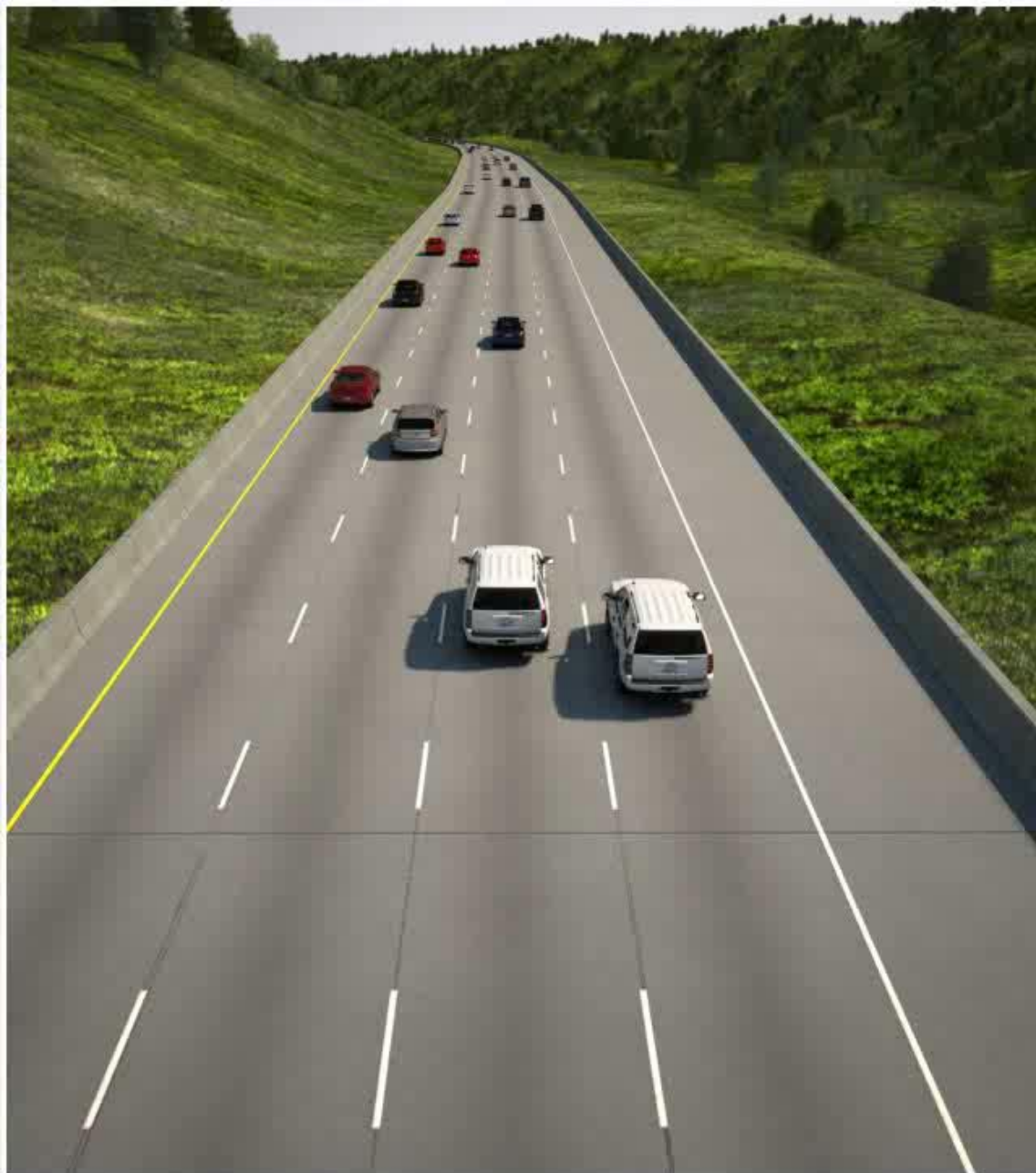
M 42 Speed Harmonization and hard shoulder lane in England. (UK Highways Agency)



Examples of ATM

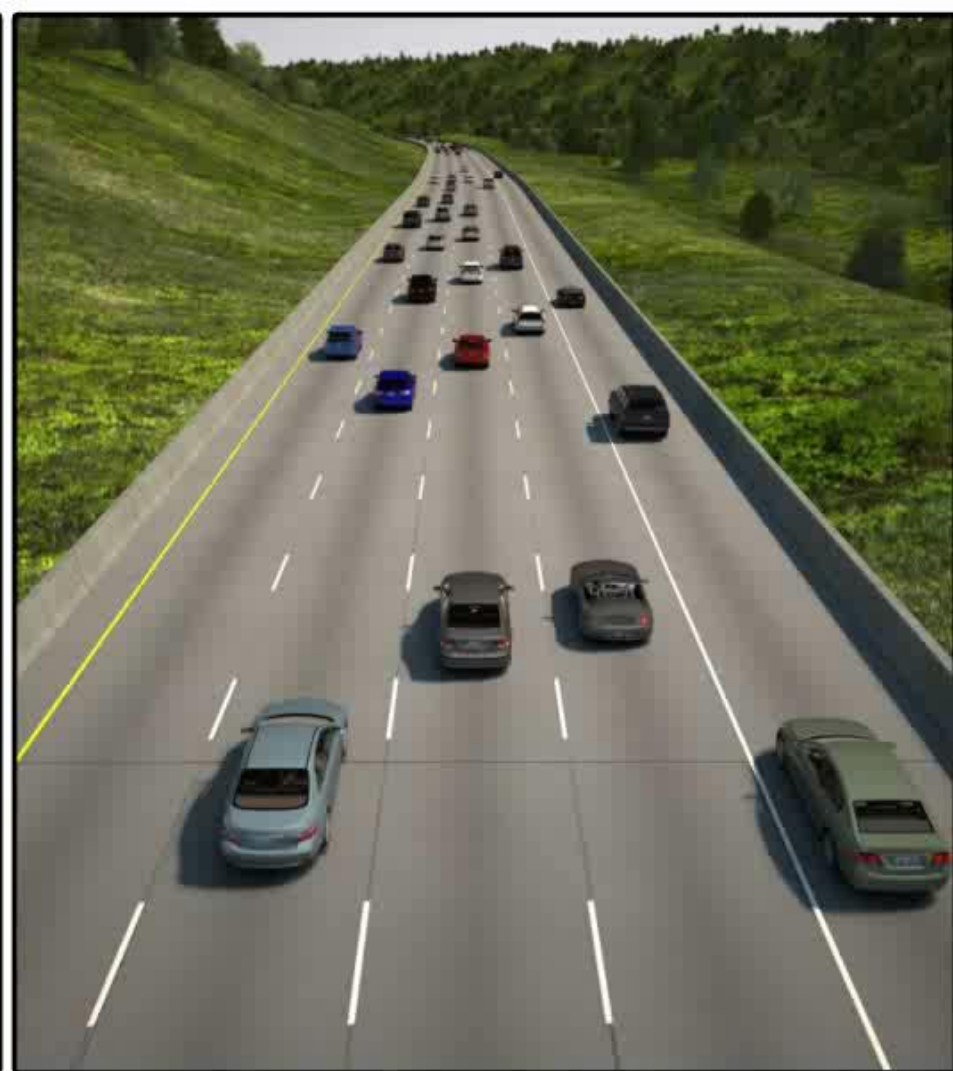
- ▶ Lane-use control
- ▶ Variable speed limits / advisories
- ▶ Queue warning
- ▶ Hard shoulder running
- ▶ Dynamic re-routing
- ▶ Junction control
- ▶ Adaptive ramp metering

***Active Traffic Management is
not limited to urban areas!***



Active Traffic Management Simulation

Scenario 3: Two-Lane Incident Closure with Congestion



Active Traffic Management Simulation

Scenario 5A: Add Lane To Drop Lane - Closed

Scenario 6A: Add Lane and Drop Lane - Open



Examples of ATM in the US

- ▶ Seattle
- ▶ Minneapolis
- ▶ I-66 (Northern Virginia)
- ▶ Los Angeles
- ▶ Dallas “Horseshoe”
- ▶ Denver
- ▶ Utah I-80 Parley’s Canyon
- ▶ SF Bay Area
- ▶ New York Long Island Expressway
- ▶ Philadelphia I-95
- ▶ Portland, OR
- ▶ New Jersey
- ▶ I-80 Wyoming
- ▶ Others?

Many examples in Europe and around the world!

Variable Speed System on Rural Corridors



I-80 in Wyoming



I-80 in Utah, Parley's Canyon

Wyoming I-80



- ▶ AADT 11,000
- ▶ <50% of I-80 traffic is heavy trucks

Significantly
reduced crashes
for trucks and
other vehicles



I-80 Integrated Corridor Mobility



Freeway Infrastructure



DOWNTOWN SF

VIA  XX MIN

VIA  XX MIN

VIA  XX MIN

SAN JOSE

VIA  XX MIN

VIA  XX MIN





I-80 Corridor

- ▶ Institutional Environment
 - ↳ 1 DOT, 9 cities, 2 MPOs, 2 transit agencies
 - ↳ Different stages of infrastructure
- ▶ Staging of implementation
 - ↳ Arterials first, freeways next (some delays due to concrete piles)
 - ↳ Some equipment went out of warranty before complete
- ▶ Maintenance
 - ↳ MOU for local agencies
 - ↳ Regional maintenance agreement for maintenance funding



OR217 Portland, OR

- ▶ Launched July 2014
- ▶ 7.5 miles,
110,000 AADT
- ▶ Incorporated travel times
- ▶ Variable speeds
- ▶ Enhanced existing adaptive ramp metering system
- ▶ Metering rates adjustable through corridor



WSDOT's Smarter Highways

- ▶ Variable speed limits, lane control, traveler information
- ▶ Reduce speeds approaching congestion, crashes, work zones
- ▶ Warn motorists of downstream queues
- ▶ Display which lanes are open, closed, and closed ahead
- ▶ Primary objective is safety improvement

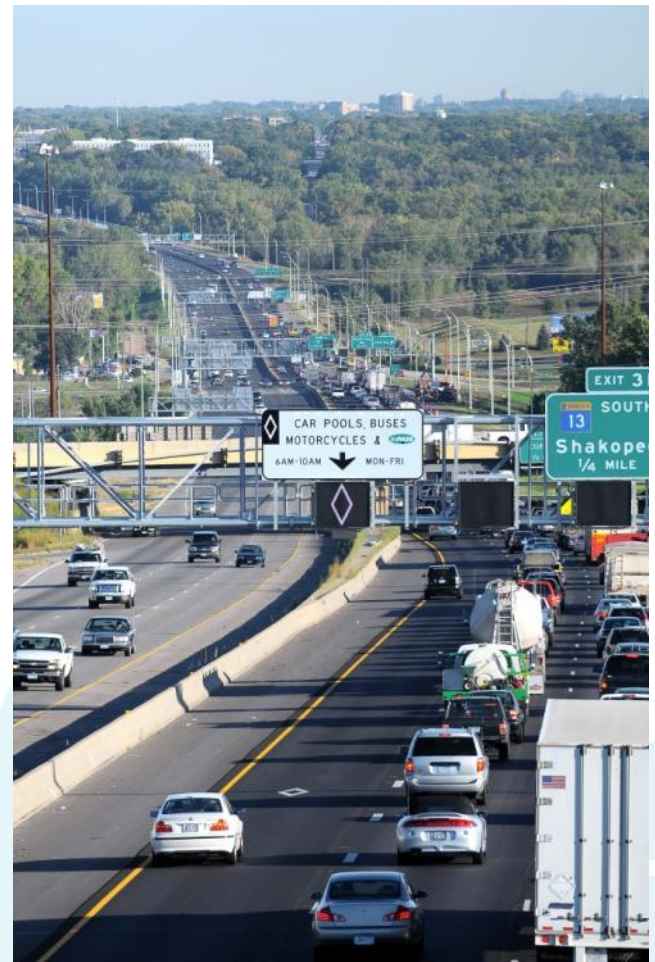


ATM in Action in Seattle Area



Minneapolis I-35W Intelligent Lane Control Signals

- ▶ ILCS located every ½ mile over every lane.
- ▶ ILCS are a 4ft x 5ft full color matrix signs.
- ▶ Use of the ILCS is primarily for incident management and speed harmonization.
- ▶ Designates when the priced dynamic shoulder lane is open or closed along with additional signing.



ATM on I-66

- ▶ Enhances existing I-66 managed lane / shoulder running
 - ↳ Lane control
 - ↳ Speed displays
- ▶ Includes Managed Lanes and ramp metering
- ▶ Now operating



VDOT I-66 ATM Normal Conditions



VDOT's I-66 ATM

Los Angeles Junction Control

- ▶ NB SR 101 to NB I-5 connector
- ▶ High collision experience
- ▶ Congestion
- ▶ High ramp demand





Re-stripe Connector to Two Lanes

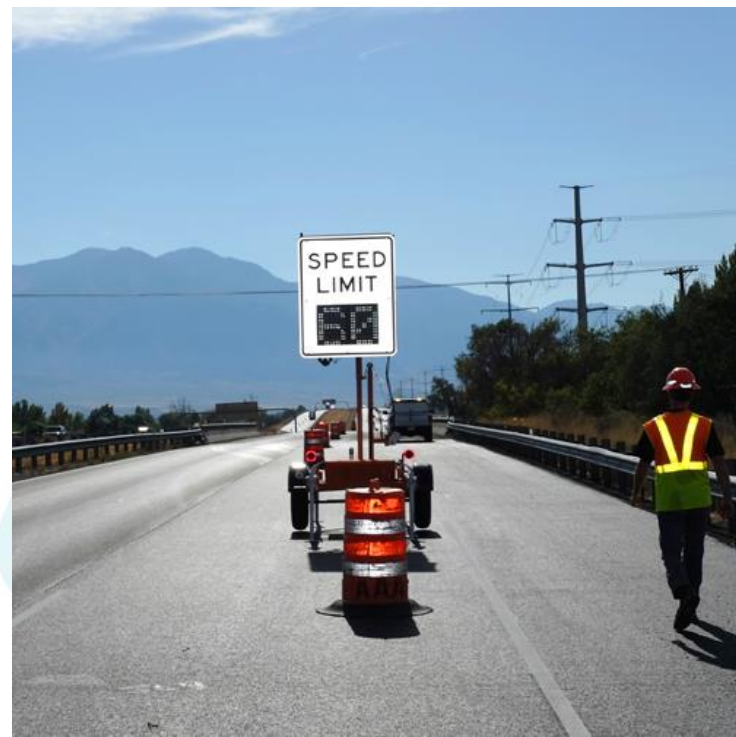


Replace Crash Attenuators



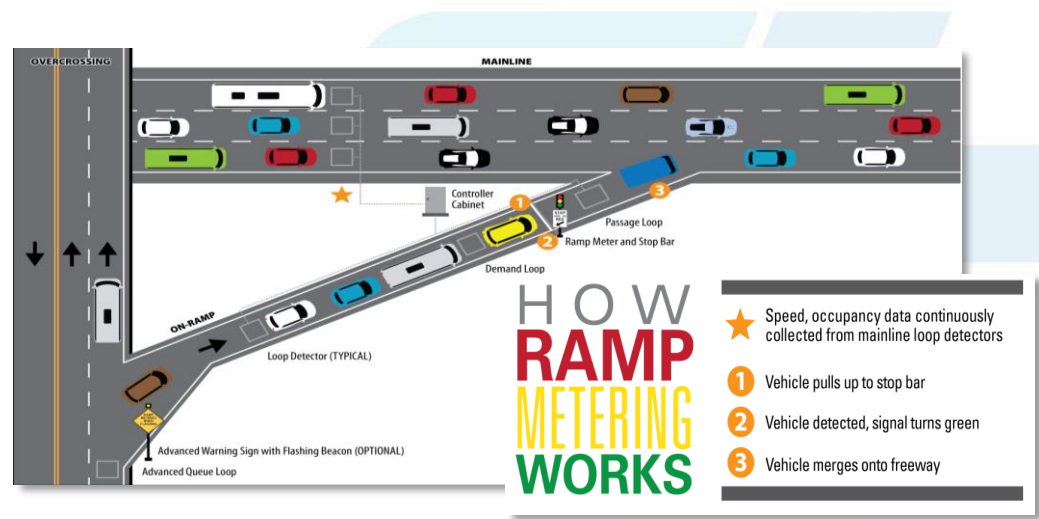
The Use of ATM is Expanding

- ▶ ATM has moved beyond stand alone implementations
- ▶ ATM is compatible with other combined, integrated approaches
 - ↳ Traffic incident management
 - ↳ Work zone traffic management
 - ↳ Managed lanes



Ramp Metering

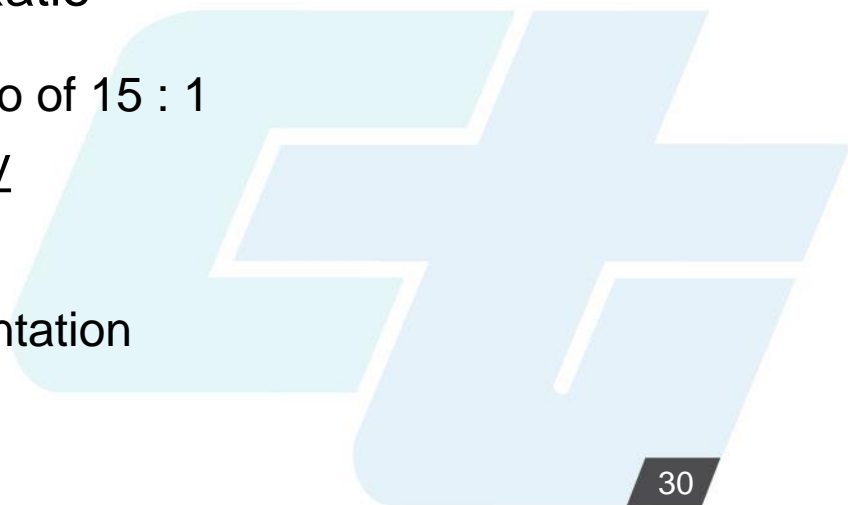
- ▶ Reduces overall freeway congestion by managing the amount of traffic entering the freeway and by breaking up platoons
- ▶ Algorithm determines entrance rate based on mainline volume, speed, queue length
 - ↳ Objective is to limit the amount of traffic entering freeway to minimize flow breakdown
- ▶ Widely used on the 50 corridor





Ramp Metering Benefits

- ▶ Mobility, Reliability, and Efficiency
 - ↳ Reduced travel times
 - ↳ Increased travel time reliability
 - ↳ Increased mainline speeds
- ▶ Safety
 - ↳ Crash reduction
- ▶ Reduced Environmental Impacts
 - ↳ Reduces stop-and-go conditions
 - ↳ Less fuel consumed
- ▶ Low cost with High Benefit/Cost Ratio
 - ↳ Cost effectiveness
 - ↳ Twin Cities metering had B/C ratio of 15 : 1
- ▶ Probably the most proven freeway management strategy
 - ↳ Leverage ITS infrastructure
 - ↳ Reduced environmental documentation



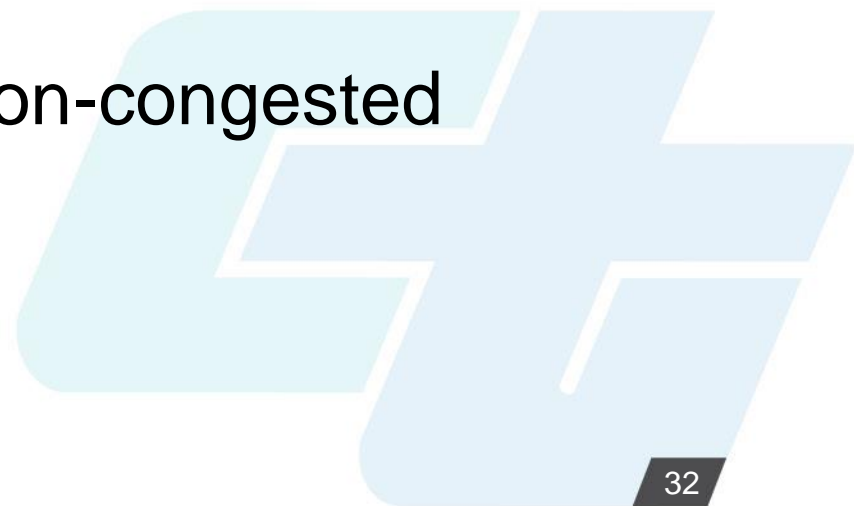
Ramp Meter Safety Benefits

Location	Benefit
Portland, OR	43% reduction in peak period collisions
Minneapolis, MN	24% reduction in peak period collisions
Seattle, WA	39% reduction in collision rate
Denver, CO	50% reduction in rear-end collisions
Detroit, MI	50% reduction in total collisions and 71% reduction in injury collisions
Long Island, NY	15% reduction in collision rate



Public Perception Challenges

- ▶ Understanding of Purpose and Benefits
- ▶ Metering during congested vs non-congested time-of-day
- ▶ Comparisons to adjacent ramp conditions
 - ↳ Wait Time
 - ↳ Cycle Length
- ▶ Metering congested vs non-congested roadways



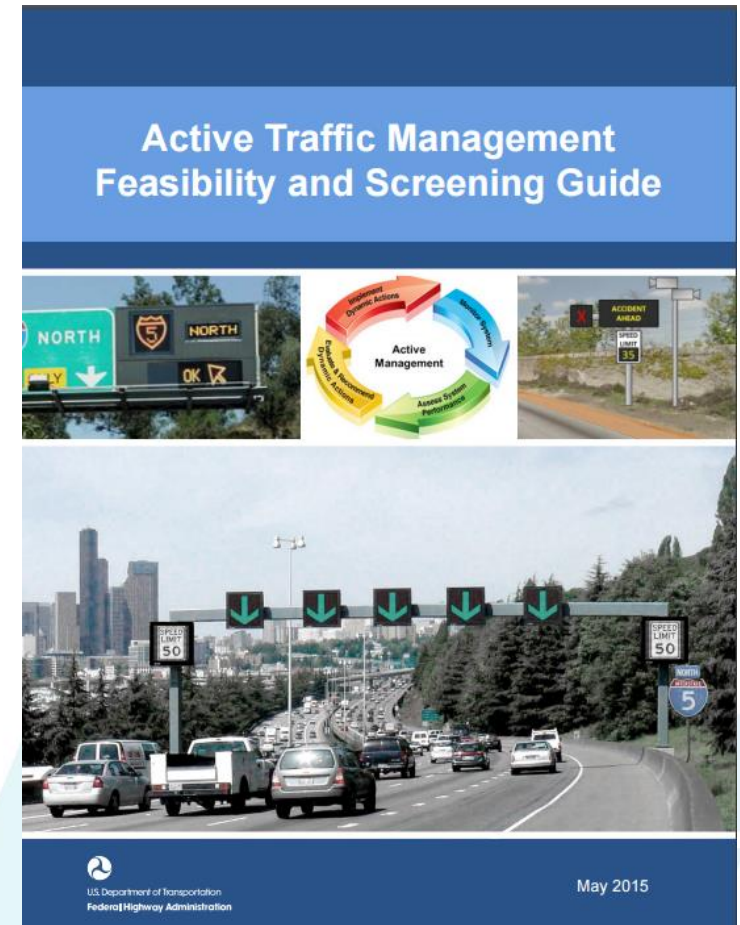


Is ATM the Right Solution?

- ▶ ATM sounds great! How do I get started?
- ▶ Important considerations:
 - ↳ What roadway networks and facilities would be best suited for ATM in my region?
 - ↳ What specific or combination of ATM strategies would work best?
 - ↳ What would be the range of expected benefits?
 - ↳ What would be the expected costs (capital and ongoing)?

Guidance Document

ATM Feasibility and Screening Guide



<http://www.ops.fhwa.dot.gov/publications/fhwahop14019/fhwahop14019.pdf>



Success Factors

- ▶ High traffic volumes
- ▶ Changes in prevailing conditions
- ▶ High prevalence of crashes
- ▶ Bottlenecks
- ▶ Adverse weather
- ▶ Variability in trip reliability
- ▶ Construction impacts
- ▶ Financial constraints
- ▶ Limitation in capacity expansion





Examples of ATM Benefits in US

I-5 Seattle

- ▶ 4.1% reduction in crashes
- ▶ 4.4 % increase in crashes on SB segment of I-5 (no ATM)

Minneapolis

- ▶ 20+ % decrease in PDO crashes
- ▶ 17% less congestion during AM peak

OR217 Portland

- ▶ 21% reduction in crashes
- ▶ 5% increase in throughput during peak period
- ▶ 10% reduction travel time variability

LA Junction Control

- ▶ NB SR-110 to NB I-5
- ▶ Average ramp delay decreased from 20 minutes to 5 minutes

- ▶ 30% decrease in crashes

Chicago Bus on Shoulder

- ▶ On-time performance from 68% to 92%
- ▶ No adverse impact on safety

Cost Considerations

- ▶ Gantries and signs
 - ↳ Need to make assumptions on spacing and layout
- ▶ Widening, refuge areas, shoulder treatments
 - ↳ Environmental issues
- ▶ Ramp treatments
- ▶ Traffic signal controllers
- ▶ Detection
- ▶ Communications / power
- ▶ New software
 - ↳ Automated algorithms / decision support
- ▶ Systems engineering activities
- ▶ Public outreach
- ▶ On-going operations and maintenance
 - ↳ Training
- ▶ Contingency



Assumptions on Gantry Spacing and Layout

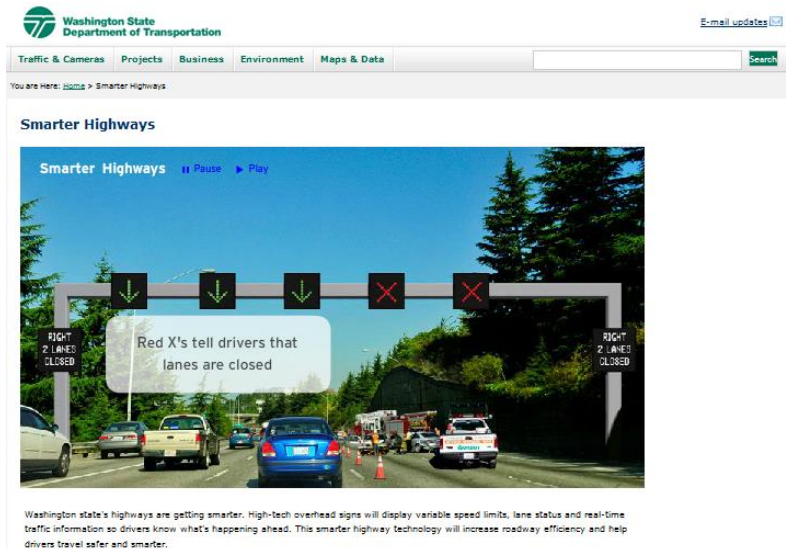
- ▶ Concerns with costs of frequent full gantries
- ▶ MUTCD requirements on guide sign distances
 - ↳ 600 to 800 feet
- ▶ Significant testing in UK of different spacing / layouts
 - ↳ Driver simulations
 - ↳ Visualization / response monitoring software

Moving towards more of a **HYBRID** approach (“ATM Lite”)

- Longer spacings between full gantries (e.g., after on ramps)
- Use of side-mounted signs in-between
- Significant reduction in costs

WSDOT Outreach Examples

- ▶ Smarter highways video on Youtube
<http://www.youtube.com/wsdot#p/u/12/cd0doR0Ga-I>
- ▶ Smarter highways www.smarterhighways.com
- ▶ Posted links on Twitter, Facebook and WSDOT blog
- ▶ Outreach to cities, counties, businesses, colleges





Group Discussion

- ▶ What other examples of ATM have you heard about?
- ▶ What technologies are in use here that you would consider active traffic management?
- ▶ Where you have deployed any of these technologies or systems, what lessons have you learned?

BREAK



Managed Lanes



What Are Managed Lanes?

- ▶ Preferential lanes or roadways
- ▶ Supporting facilities and programs
- ▶ Optimize efficiency, performance and throughput
- ▶ Offer travel time savings and reliability
- ▶ Apply management strategies including:
 - ↳ vehicle occupancy,
 - ↳ vehicle eligibility,
 - ↳ pricing, and
 - ↳ access control





Managed Lanes

- ▶ Are HOV lanes a “Managed Lane”?
- ▶ What other types of managed lanes are you aware of?



Managed Lanes Concept

► Managed Lanes are identified by many names:

- ↳ High-Occupancy Vehicle (HOV) lanes
- ↳ High-Occupancy Toll (HOT) lanes
- ↳ Express Lanes
- ↳ Express Toll Lanes (ETL)

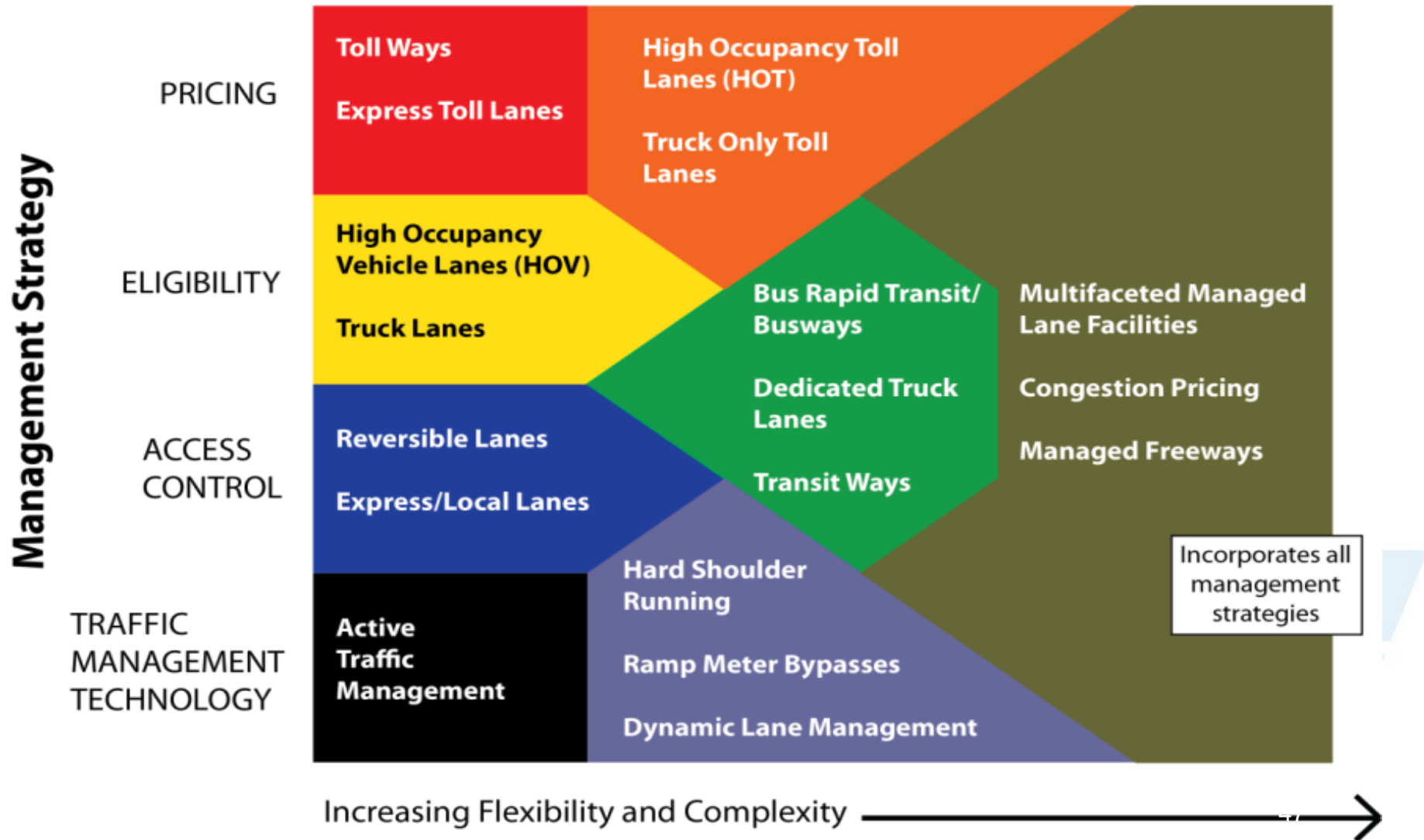
► Local names and branding can vary and can be reflective of differing lane management strategies:

- ↳ Good-to-Go Lanes, Sane Lanes, MnPass Lanes, FastLanes, TEXpress





Managed Lanes Take Many Forms





Benefits of Managed Lanes

	Building General Lane	Building Managed Lane
Short Term	Average vehicle speeds about the same	
Medium Term	<ul style="list-style-type: none"> • Congestion builds in all lanes • Benefits of the new capacity diminish 	<ul style="list-style-type: none"> • Travel time benefits in the express lanes maintained • Overall shorter average travel times across the whole corridor
Long Term	<ul style="list-style-type: none"> • Congestion returns to all lanes • No measurable benefit in travel time from new capacity 	<ul style="list-style-type: none"> • Congestion returns only to general purpose lanes • Managed lanes continue to serve more vehicles at higher speeds • Greater overall corridor travel time benefits

Why Are Managed Lanes More Efficient?

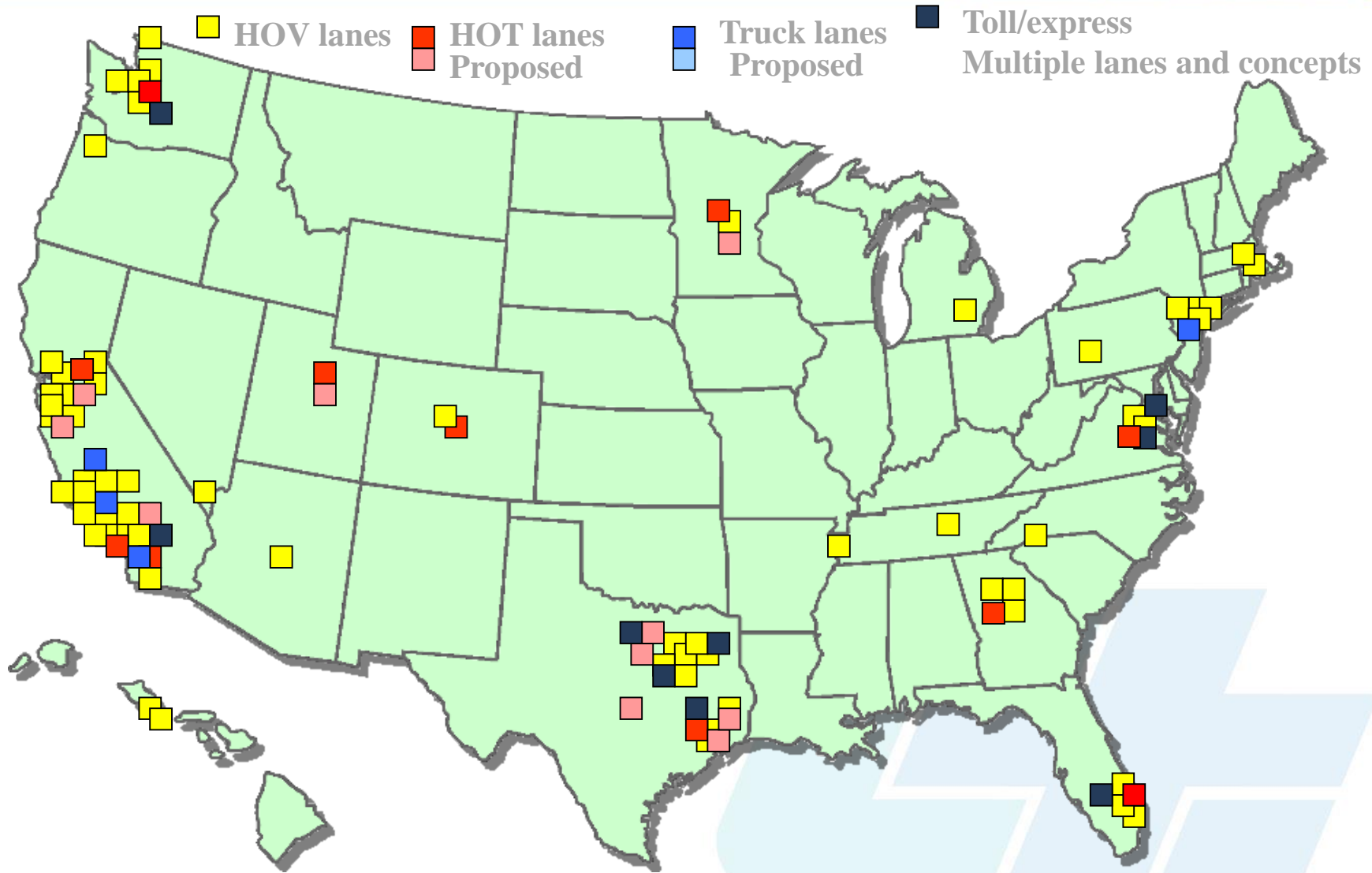


SR 91,
Orange
County CA

*Each lane is moving 1300
vehicles at 25 mph*

Each lane is moving 1600
vehicles at 60 mph

MULTI-DIRECTIONAL OPERATIONS FORCES Are Proposed



Managed Lanes Design

- Initially tolled managed lanes were fully-separated facilities.



SR-91



I-25



I-15



I-10

Managed Lanes Design

- ▶ New Managed Lanes are more integrated into the freeway with less physical separation.



SR-167



I-95



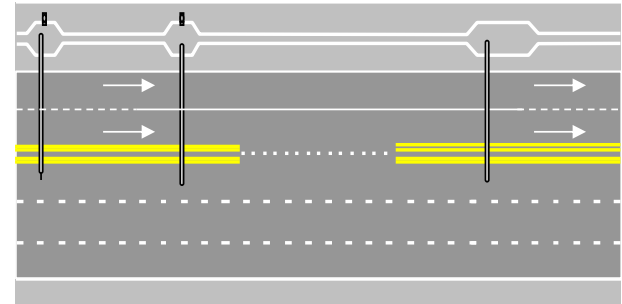
I-85



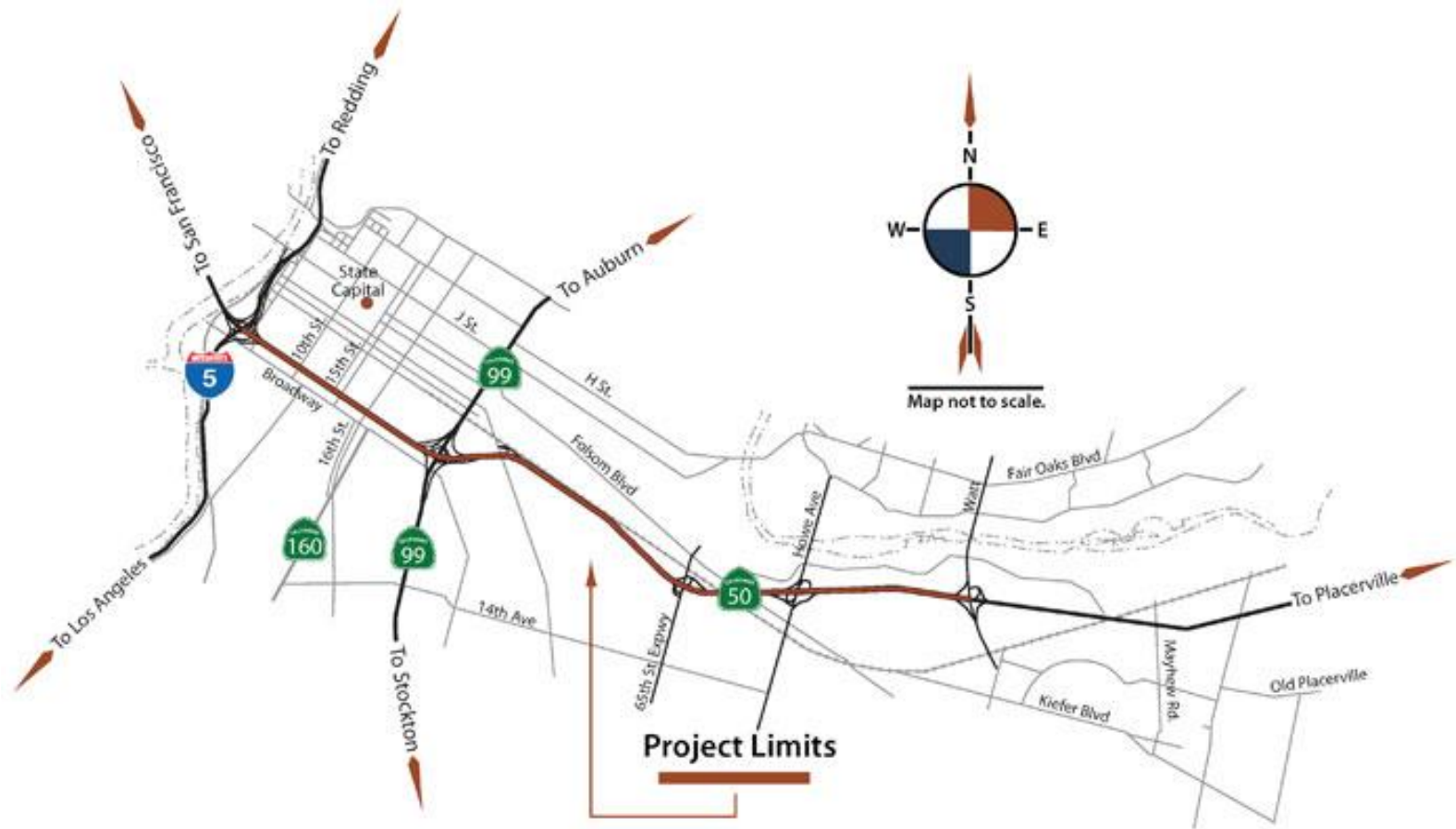
I-35W

Access Options

- ▶ Open or continuous access
 - ↳ Drivers can enter the lane at any location
- ▶ Access zones
- ▶ Slip ramps
- ▶ Direct access ramps



US 50 HOV Plan



Why Should We Use Pricing?

- ▶ Generates Revenue
 - ↳ Afford more than we could otherwise build and maintain
- ▶ Meters Traffic
 - ↳ Higher travel speeds accrue in medium and (especially) long term
 - ↳ Pricing more efficient than signalization or rationing



You Don't Need a Price to Meter: I-70 (Colorado) meters traffic through mainline traffic signals.



Managed Lane Technologies

- ▶ Toll tags (transponders)
- ▶ Roadway tolling equipment
- ▶ Enforcement
- ▶ Toll rate signs
- ▶ Back office / customer service center

Often, these technologies are new to a DOT and to the Operations staff.

Toll Tags / Transponders

- ▶ Identifies the account for toll charging
- ▶ Uses radio frequency
- ▶ Read by antenna and reader at toll points
- ▶ Common types
 - ↳ EXPass
 - ↳ Title 21
 - ↳ 6(c)
- ▶ May include mechanism to “declare” carpool



Roadway Tolling Equipment

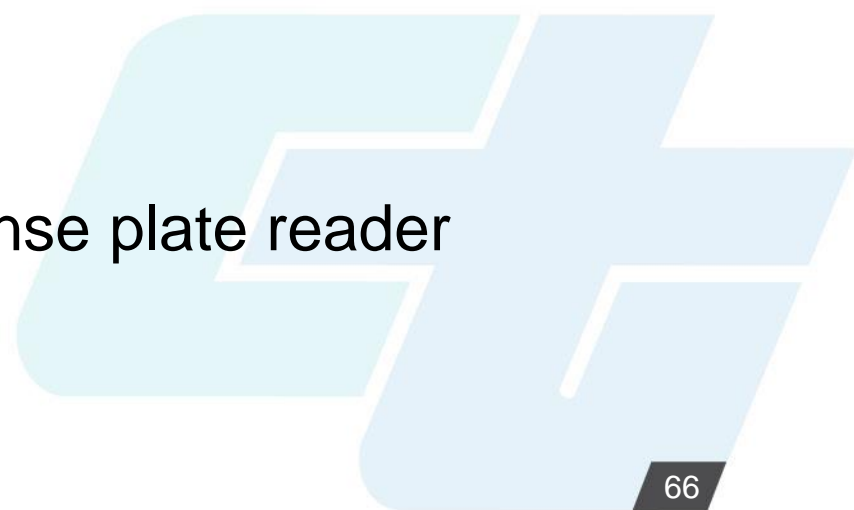
- ▶ Antenna
- ▶ Reader
- ▶ Controller
- ▶ Cameras (enforcement and photo tolling)
- ▶ Detectors
 - ↳ Vehicle detection and axle count





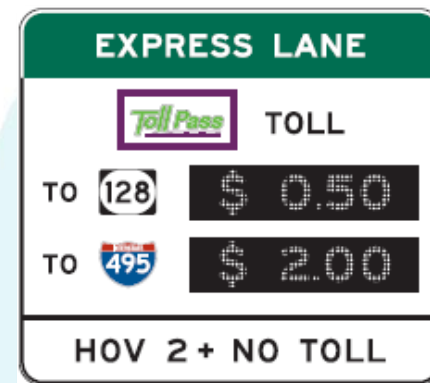
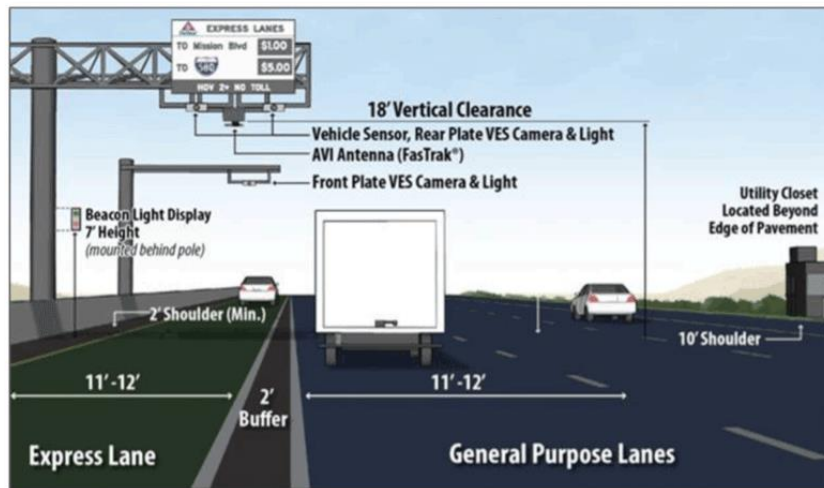
Enforcement

- ▶ Toll enforcement often by license plate recognition
 - ↳ If no toll tag...
 - ↳ Violation
 - ↳ Pay-by-plate
 - ↳ Pay-by-mail
- ▶ HOV enforcement is generally by law enforcement
 - ↳ Must observe violation
 - ↳ Declaration mechanism
 - ↳ Beacons at toll points
 - ↳ Registration and mobile license plate reader



Toll Rate Signs

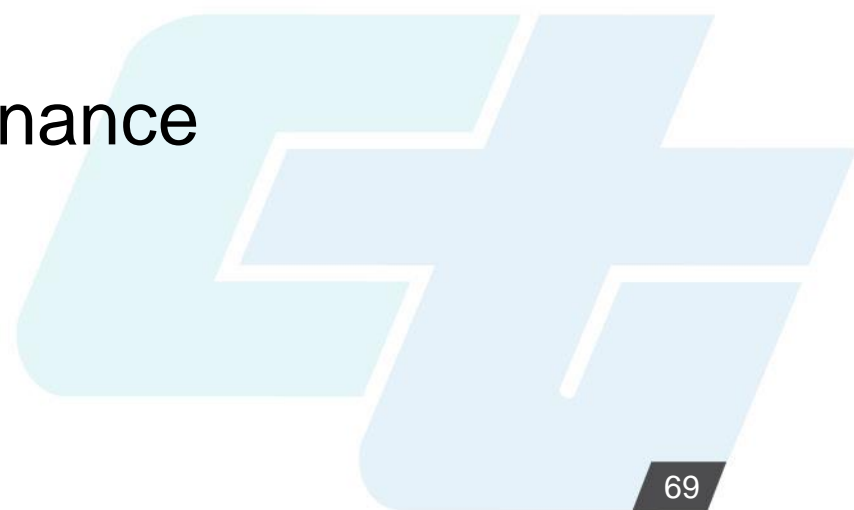
- ▶ Spread along managed lane
 - ↳ In advance of designated access points
 - ↳ Distributed more evenly in continuous or near continuous access systems
- ▶ Displays the toll charge to destination(s)





General Lessons Learned

- ▶ Different types of feasibility:
 - ↳ Technical
 - ↳ Institutional
 - ↳ Financial
 - ↳ Public/political
- ▶ Speed differential: lane separation
- ▶ Enforcement
- ▶ Partnering and governance





Pricing/Revenue Lessons Learned

- ▶ What goal is the most important?
 - ↳ Better management, transit/rideshare promotion, revenue generation.
 - ↳ Improved lane management is primary reason for adding pricing to HOV lanes.
- ▶ Public/political support is greatest challenge
- ▶ Adding pricing requires many changes (it's not just about pricing).
- ▶ Highly discretionary demand caused revenue forecasts to be overestimated on early projects.
- ▶ Most HOV conversion projects only cover O&M costs.
- ▶ Revenue generation requires 2 or more lanes and/or restricting free use to 3+.



Managed Lanes Take-Aways

- ▶ What are the advantages or disadvantages of migrating from HOV to HOT lanes?
 - ↳ Do HOV lanes have a role in the long run?
- ▶ How does the approach to managed lanes differ if revenue generation is the primary goal vs. traffic management?
 - ↳ Once revenue starts to be generated, will the importance of revenue become paramount regardless of the initial goal?



INTEGRATED CORRIDOR MANAGEMENT

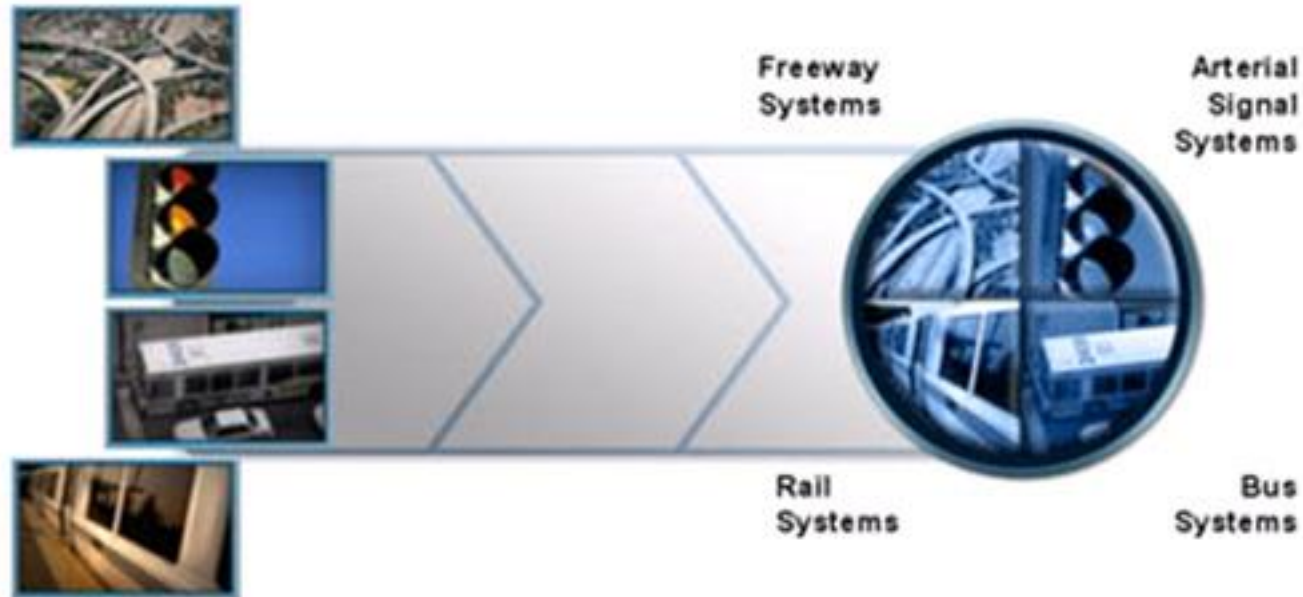




Integrated Corridor Management

- ▶ ICM Background and Concepts
- ▶ Status of the Federal ICM Initiative and Sites
- ▶ Planning for ICM
 - ↳ Stakeholders
 - ↳ Integrating with existing plans and programs
 - ↳ ICM Concept of Operations
 - ↳ Agreements
 - ↳ Modeling and Performance Measures
- ▶ Integration to Support ICM Strategies

What Is ICM?



- ▶ **Maximize corridor capacity through:**
 - ▶ New institutional models
 - ▶ New technology
 - ▶ More dynamic operational strategies



USDOT ICM Initiative

ICM Pilot Sites:

- San Diego, CA
- Dallas, TX

Key Elements:

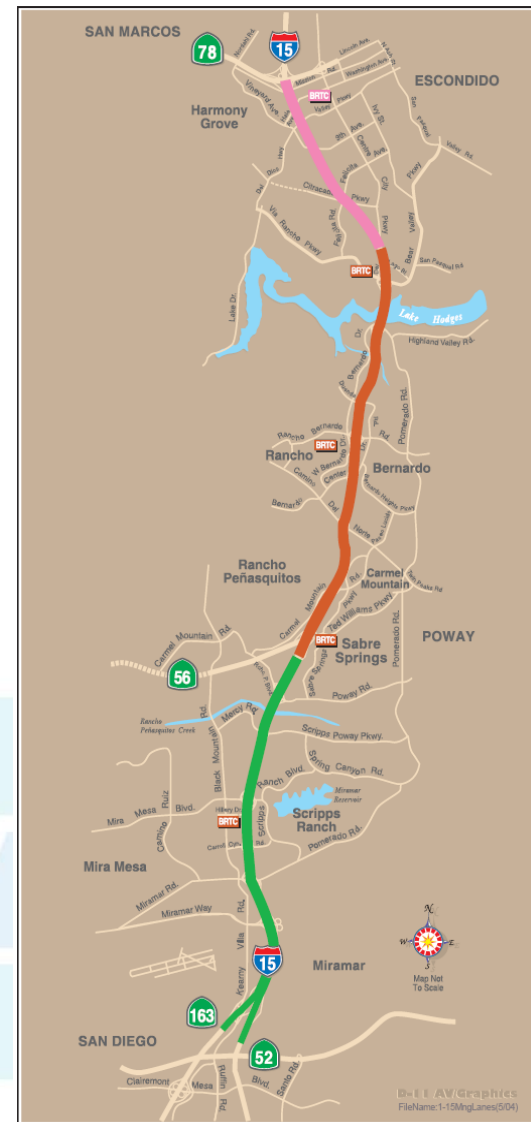
- Decision Support Systems
- Institutional Agreements
- Operational Strategies
- Multimodal

ICM Planning Grants:

- I-10, Phoenix, AZ
- I-210, LA/Pasadena, CA
- SR4, Bay Area, CA
- I-95, Broward Co., FL
- I-95/MD295/US1, Baltimore, MD
- NJ Turnpike and US1
- NYC – multiple corridors
- I-90 Buffalo-Niagra, NY
- I-84, Portland, OR
- IH-10/US-54/IH-110, El Paso, TX
- IH-35, Austin, TX
- I-15, Salt Lake City, UT
- Northern VA – multiple corridors

SANDAG I-15 ICM

- ▶ Primary artery for the movement of commuters, goods, and services from north San Diego County to downtown.
- ▶ I-15 Managed Lanes System
- ▶ Multi Institutional Cooperation/ Partnerships
- ▶ Multi-modal Transportation Improvement Strategies and Mode Shift – BRT, TSP
- ▶ 511, including transit information



“Response Postures”

Response Posture	Event Impact (congestion, construction, incident, etc.)		
	Low	Medium	High
Light	Conservative	Conservative	Moderate
Moderate	Conservative	Moderate	Aggressive
Heavy	Moderate	Aggressive	Aggressive

Demand

Light

- Weekends
- Holidays

Moderate

- Off-peak weekday
- Minor weekend special event

Heavy

- Peak-hour weekday traffic

Response Posture

Conservative

- Example – Provide slight increase to ramp metering rate

Moderate

- Example – Provide additional green-time to favor northbound traffic while still providing adequate cross-street timing

Aggressive

- Example – Display alternate route for freeway traffic on CSM, such as “INCIDENT AHEAD NB USE POMERADO”

Event Impact

Low

- Incident closing freeway shoulder or one lane
- Construction closing one lane of primary arterial
- Breakdown of transit vehicle

Medium

- Incident closing 1 freeway lane
- Closure of Express Lanes
- Construction on Pomeroado reducing NB and SB to one lane each direction

High

- Major incident at intersection of primary arterials
- Closure of two or more lanes of the freeway
- Combination of low and medium incidents

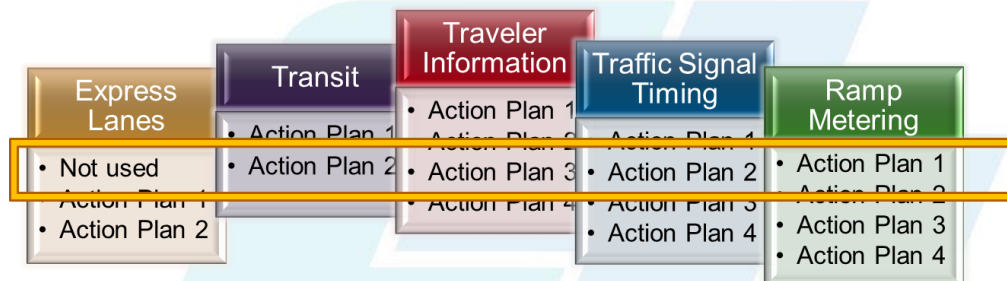
I-15 ICM Response Plans

- ▶ 156 Alternate Routes
- ▶ 260 Local Arterial Intersections
- ▶ 18 Metered Interchanges
- ▶ 20 Dynamic Message Signs
- ▶ 5 BRT stations
- ▶ 20 miles HOT – reversible lanes
- ▶ 30 miles Traffic Responsive
- ▶ 511 (including app)

Limited set of “point-in-time” Response Plans by:

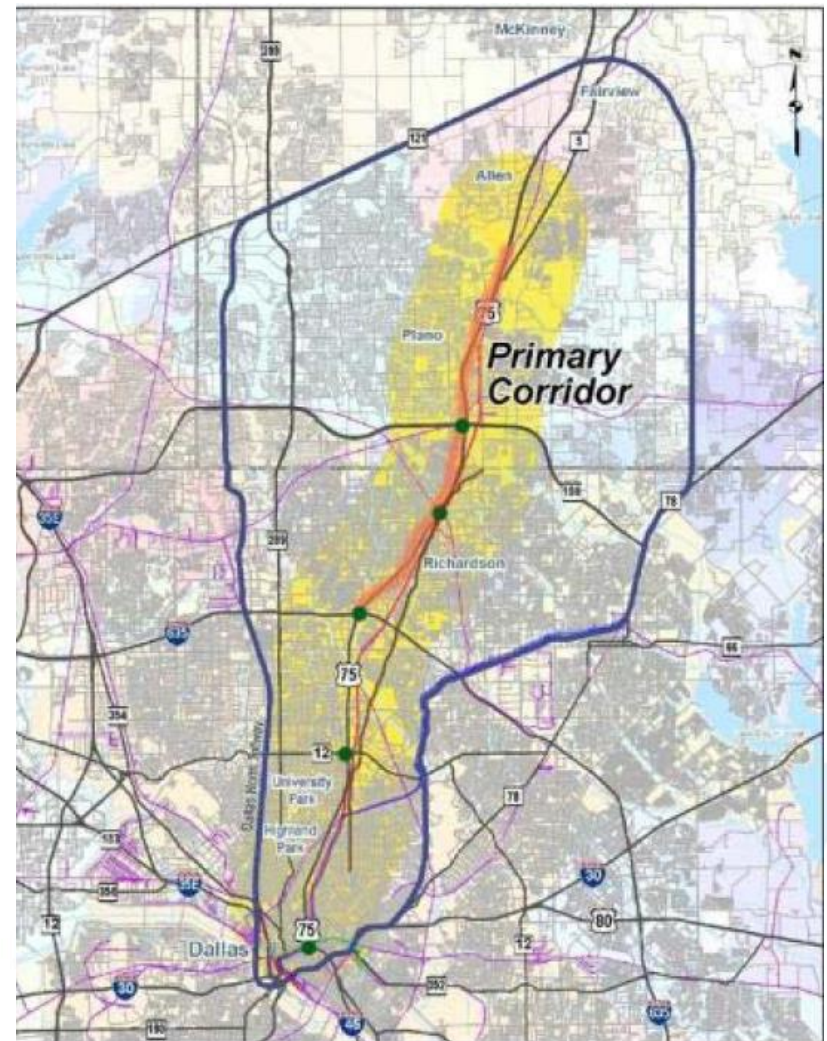
- Using Asset Restrictions
- Using Availability Conditions
- Using Thresholds to select “next move” relationships

= 1.5 billion combinations!

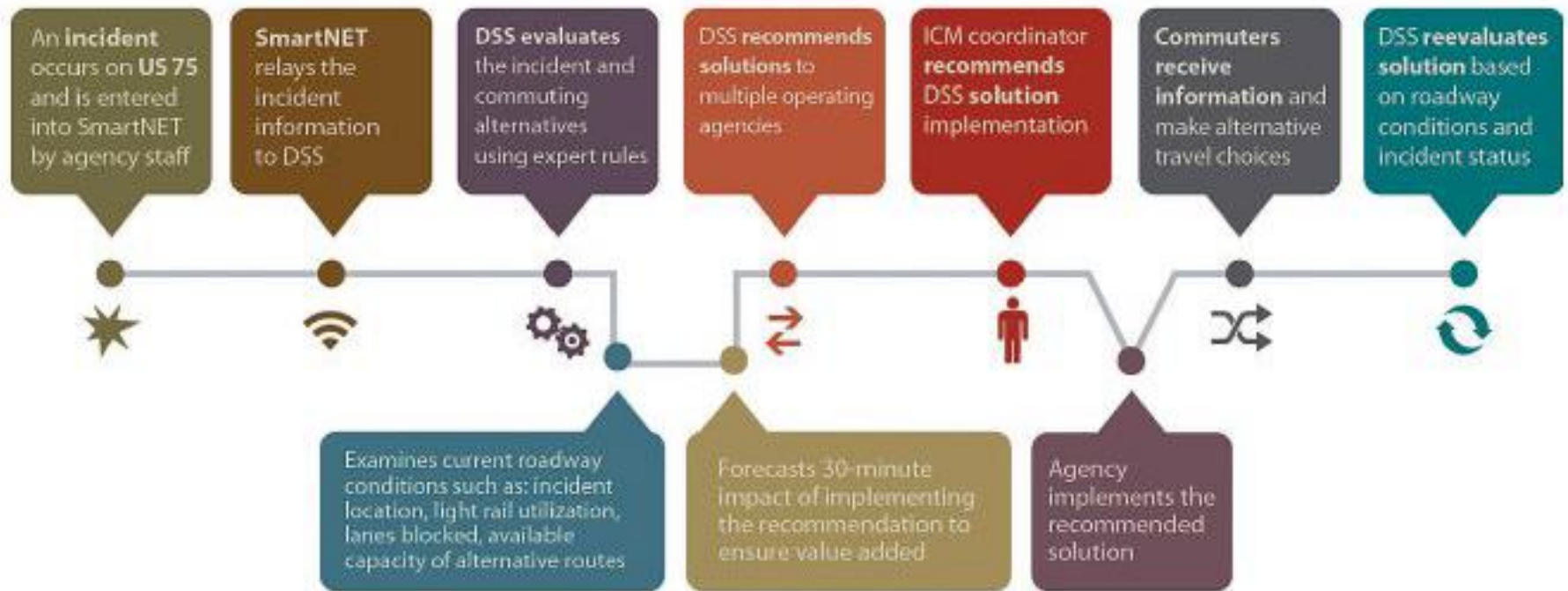


Dallas US-75 ICM

- ▶ Freeway with continuous frontage roads
- ▶ Managed HOV lanes
- ▶ Dallas North Tollway
- ▶ Arterials
- ▶ Bus Network, Light Rail
- ▶ Approx. 900 traffic signals
- ▶ Multiple TMCs
- ▶ Regional ATIS (511)



US 75 ICM Decision Support



THE BENEFITS



Improved travel time reliability for commuters



Enhanced decision making support for operating agencies



Achieves a 20:1 return (\$278.8 million) on the project's cost over 10 years



Less pollution from idling vehicles in congested traffic



USDOT ICM Status Update

- ▶ San Diego and Dallas went “live” in early 2013
- ▶ Testing and evaluating the DSS in both regions (3-year evaluation)
- ▶ Independent evaluation
- ▶ Early lessons:
 - ↳ Agreements are tough. Most challenging part of ICM.
 - ↳ Data integration from multiple systems and multiple networks
 - ↳ Determining mode shift is difficult, working through how to evaluate effectiveness
 - ↳ Combinations of strategies also are challenging to evaluate

AZ Loop 101 ICM

- ▶ Arizona DOT, Scottsdale, Maricopa County, SRPMIC Tribe
- ▶ Event-driven ICM for freeway closures
- ▶ Positives:
 - ↳ Dense arterial ITS
 - ↳ Experienced TMC staff
 - ↳ Provide arterial alt route
 - ↳ REACT to support arterial traffic diversions
- ▶ Focus on process improvements
- ▶ No new infrastructure





California Connected Corridors

- ▶ Initiated in 2011 – Statewide Framework
- ▶ Focus on planning, implementation, O&M
 - ↳ Implement TSM&O on their most congested corridors (50)
 - ↳ Evolve Caltrans to real-time operations and management
 - ↳ Enhance partnerships
 - ↳ Optimize infrastructure and capacity
 - ↳ Improve overall corridor performance

Connected Corridors – VIP Vehicles, Infrastructure and People

Connected
&
Automated
Vehicles

Connected
Infrastructure

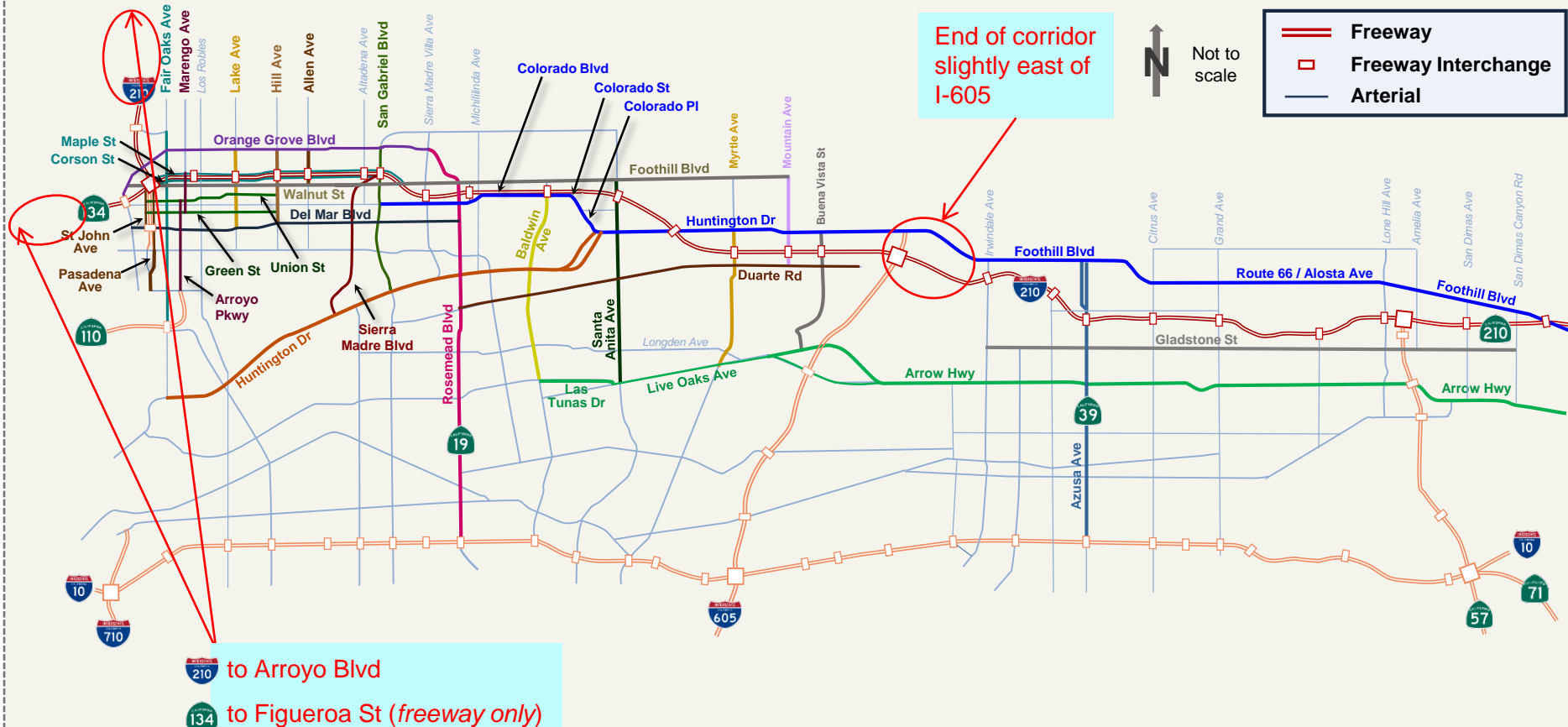
Connected
Travelers

Enhanced
Decision
Support

Corridor
Centric
Social
Networking

I-210 Project Corridor (Pilot)

Segment 1 Area of Interest





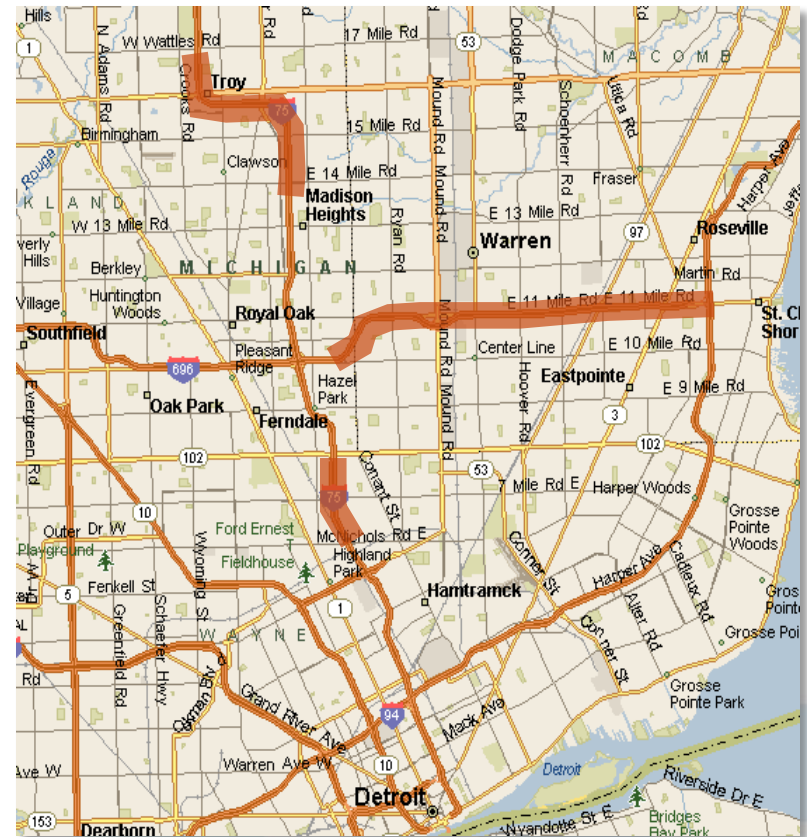
Michigan DOT I-75 Concept of Operations

- ▶ Travel time **reliability** within the corridor (freeways and arterials)
- ▶ Improved traveler information
- ▶ Incident response
- ▶ Improved agency coordination
- ▶ Coordinated use of resources and technologies
- ▶ Public outreach and education on multi-modal transportation options
- ▶ CVO through the corridor
- ▶ Developed a ConOps and Requirements (2008)
- ▶ Corridor Integration CMM helped guide areas for improvement



MDOT ICM Pilot Corridors

- ▶ 2 Pilots on I-75 (Wayne and Oakland Counties); I-696 in Macomb
- ▶ Event-based
 - ↳ Improve response to major incidents
 - ↳ Traffic rerouting on arterials
- ▶ ITS equipment upgrades and infill
- ▶ Signal timing on alt routes
 - ↳ Models show freeway recovery times increasing by 15-30 minutes





Stakeholder Roles for ICM

- ▶ Identifying the right partners
- ▶ Key partners
 - ↳ Freeway management and operations – TOC, freeway service patrol, freeway incident response
 - ↳ Arterial management and operations – TOC, signal operations
 - ↳ Transit
 - ↳ Incident response and management – freeway and arterial incident response/law enforcement
 - ↳ MPO – planning
 - ↳ Others to be determined on a regional level based on operational need
- ▶ ***Leadership commitment – key to sustaining partnerships. You already have this!***



Leveraging ICM

- ▶ ITS Plans or Updates/TSMO Planning
- ▶ Traffic Incident Management Coalitions
- ▶ Standing Committee Meetings (ITS Partners)
- ▶ Large-scale freeway or arterial improvement projects
- ▶ TIP funding cycles
- ▶ RTP updates
- ▶ Follow up initiatives from RCTO and other Ops Plans

Plant seeds, build interest, introduce ICM as a collaborative, regional effort



Analysis, Modeling and Simulation

- ▶ Test different scenarios identified in the ConOps
- ▶ Used available data and future projections
- ▶ Modeled ICM strategies under typical and incident conditions
- ▶ Results from the AMS showed:
 - ↳ Improved mobility, particularly during NRC
 - ↳ Improved reliability – 2% - 23%
 - ↳ Reduced toxic emissions and fuel consumption
 - ↳ Strong potential for fiscal benefits



ICM Performance Measures

► National evaluation is looking at the following MOEs:

- ↳ Vehicle and person throughput
- ↳ Travel times and travel time index
- ↳ Standard deviation of travel time
- ↳ 80th, 90th, and 95th percentile travel times
- ↳ Buffer and Planning Indices
- ↳ Traveler Response
- ↳ Safety benefits

► Other ICM Objectives could be...

- ↳ Traveler information
- ↳ TIM
- ↳ Data sharing
- ↳ Institutional participation





Demonstration Site Measures

San Diego

- ▶ Travel Time
- ▶ Delay
- ▶ Throughput
- ▶ Reliability and Variance of Travel Time
- ▶ Safety
- ▶ Emissions and Fuel Consumption

Dallas

- ▶ Travel Time Reliability
- ▶ Increase Corridor Throughput
- ▶ Improve Incident Management
- ▶ Enable Intermodal Travel Decisions

Interagency Agreements

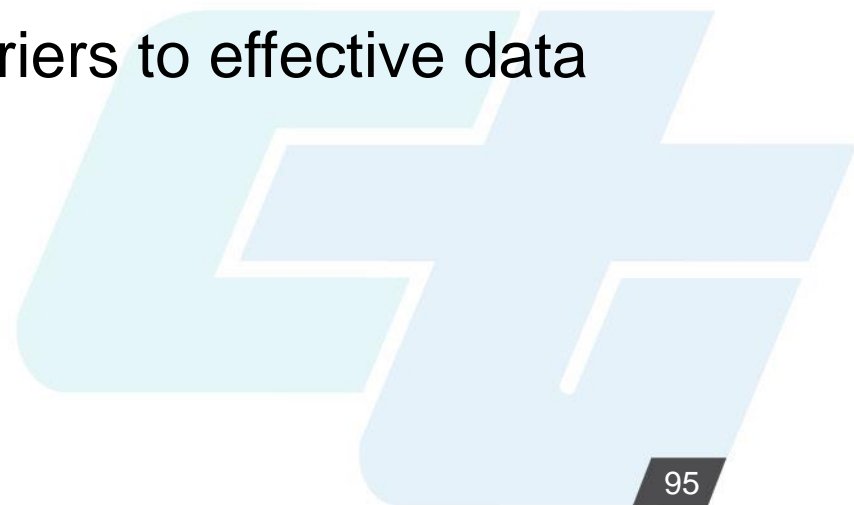
- ▶ Essential for ICM and multi-agency operations strategies
- ▶ New operations models, potential for joint operations
- ▶ Data sharing and system connectivity
- ▶ Often, the most complex part of an ICM program and strategy
- ▶ Examples – I-80, SANDAG, AZ
 - ↳ Operating and operating authority
 - ↳ Data sharing parameters
 - ↳ Cost sharing
 - ↳ Decision making



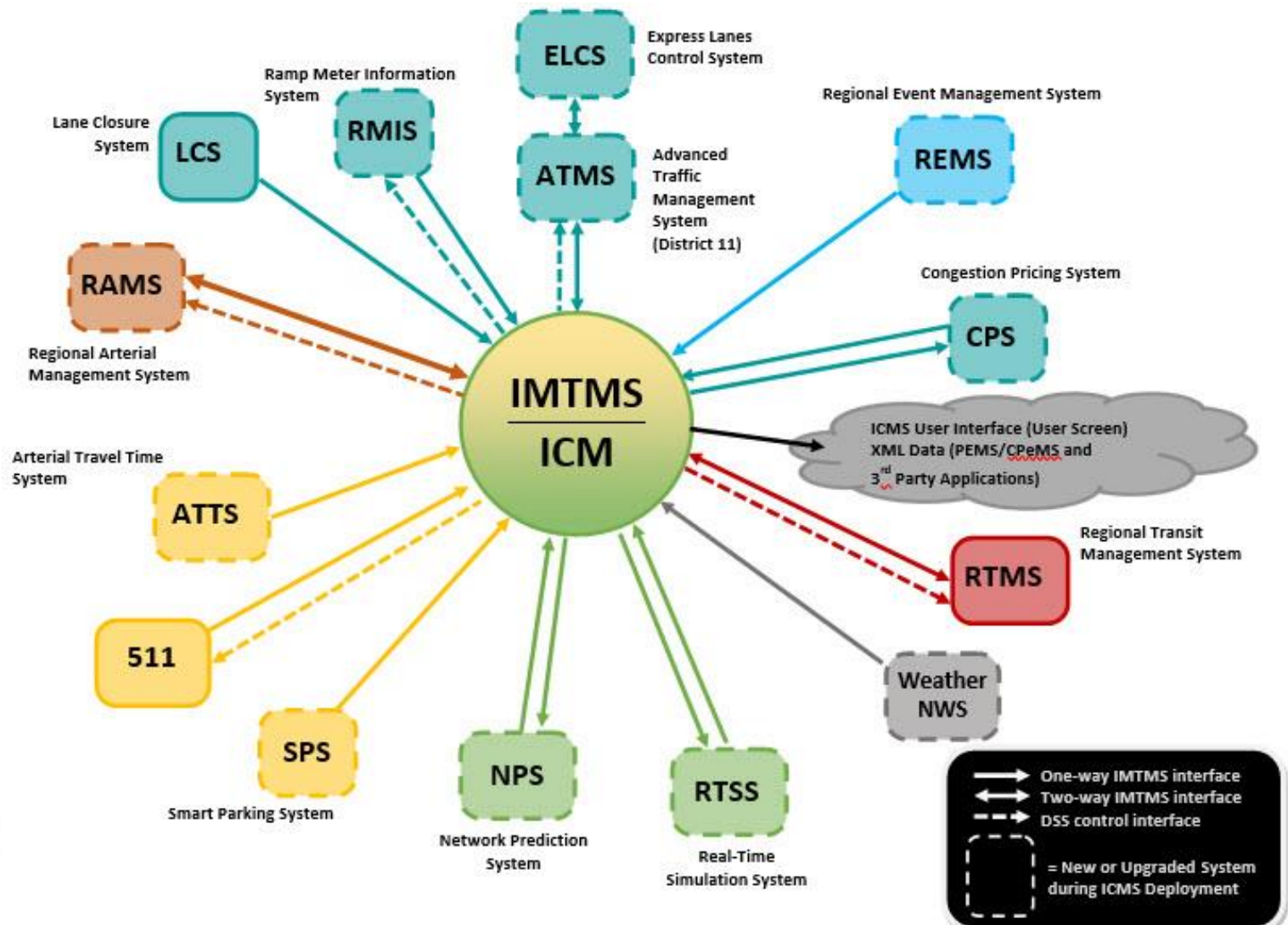


Real-time Data Sharing to Support ICM

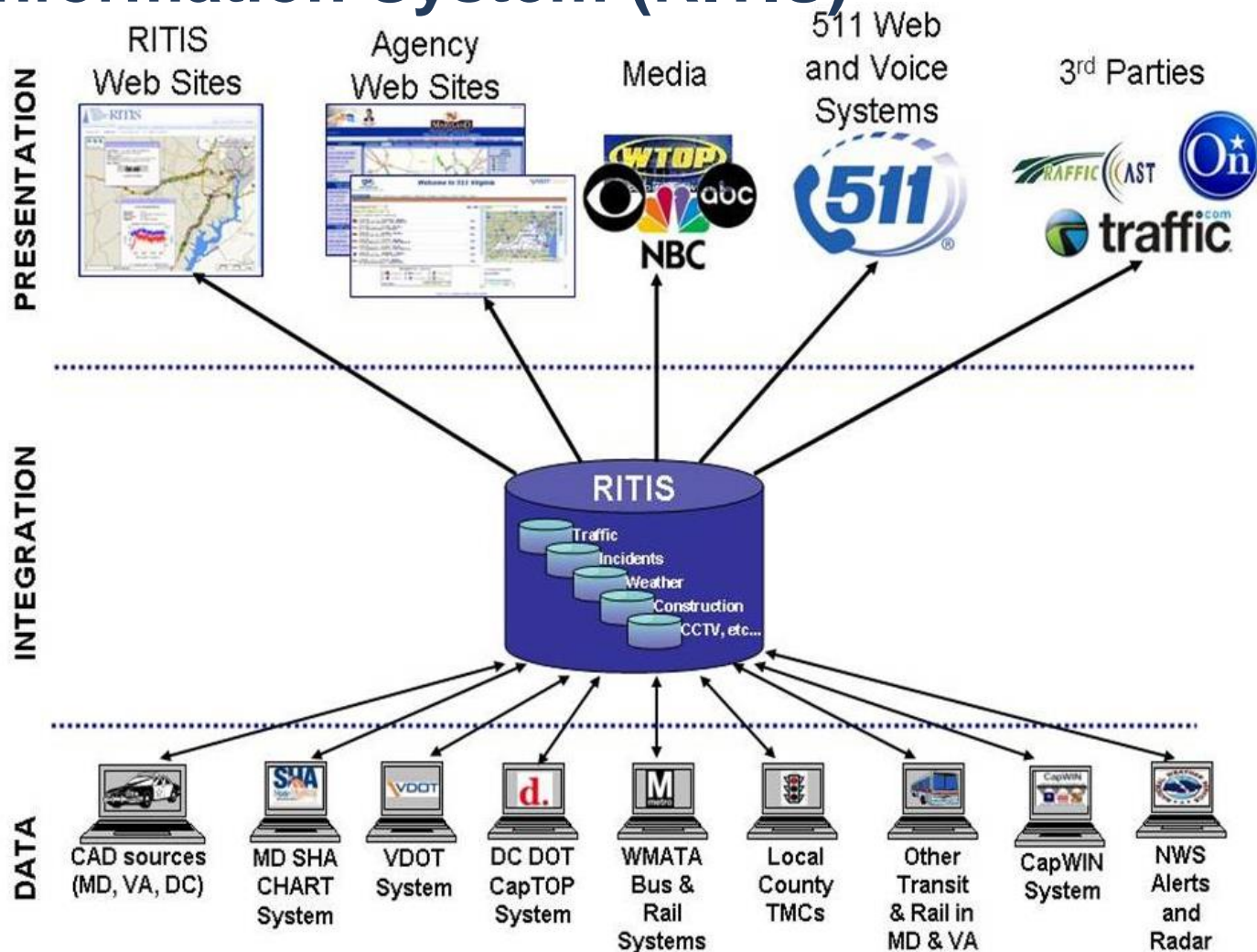
- ▶ Regional strategies for sharing data
- ▶ What information do partners need?
- ▶ Operations data to support ICM
 - ↳ Real-time freeway, arterial and transit operations
 - ↳ Real-time strategy implementation information
 - ↳ Agency notifications
- ▶ Overcoming institutional barriers to effective data sharing
 - ↳ RITIS (I-95)
 - ↳ RADS (Arizona)



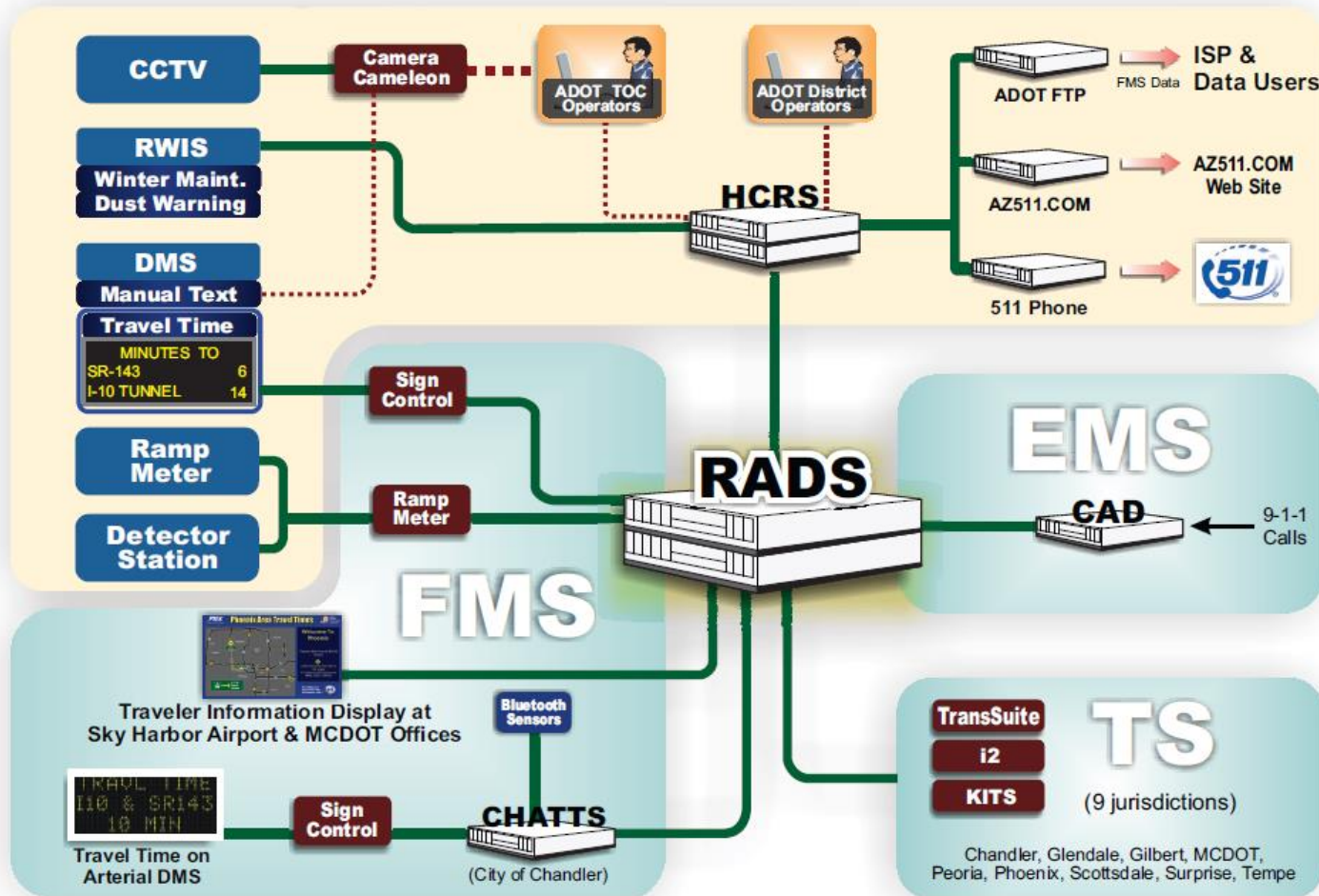
SANDAG Data Hub



Regional Integrated Transportation Information System (RITIS)



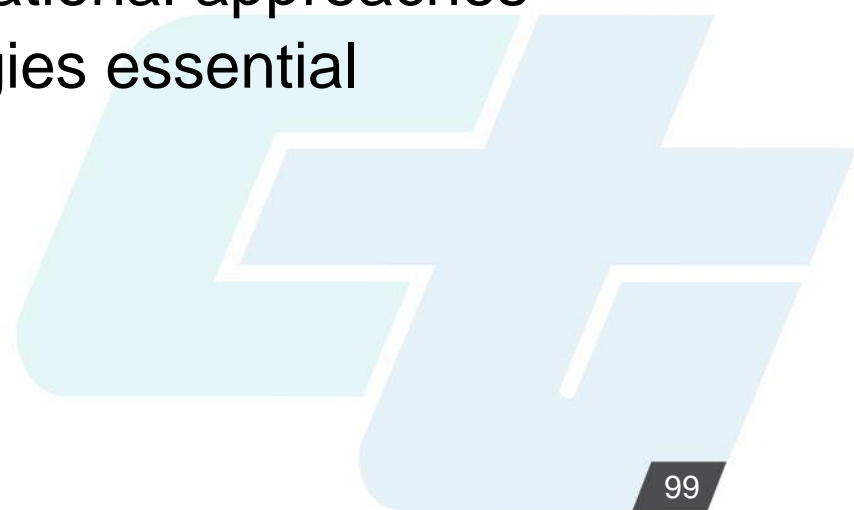
Regional Archived Data System





Staffing and Training

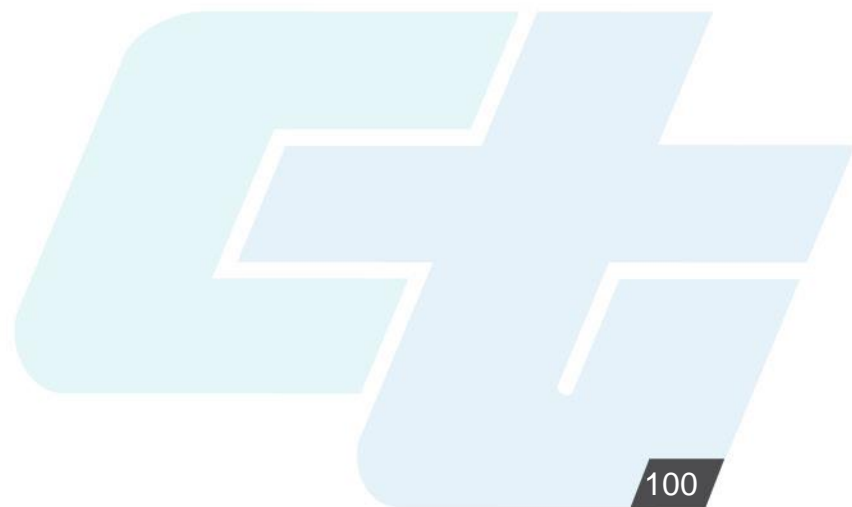
- ▶ Staff capacity building
 - ↳ Current staff vs. supplementing staff
 - ↳ Leveraging available regional technical staff resources
- ▶ Staff training needs for ICM and next-generation operations
 - ↳ New systems and new operational approaches
 - ↳ Multi-agency training strategies essential





ICM Resources

- ▶ its.dot.gov/icms
 - ↳ ICM Knowledge and Technology Transfer (KTT)
 - ↳ Guidance documents for each stage – planning, stakeholder engagement, design, test plan, modeling, training, lessons learned
 - ↳ Fact sheets





Managing a Corridor Considerations

- ▶ What are your initial considerations?
- ▶ How would you go about developing a plan for corridor management?
- ▶ Who would you involve?
- ▶ What technologies/systems/actions would you consider?
- ▶ What are the major gaps or challenges you see in implementing the plan?
- ▶ What would you do to give your plan the best chance of success, especially considering the gaps/challenges?



Breakout Group Activity

- ▶ Once US50 ICM is implemented, how do you see agency roles and responsibilities changing?
 - ↳ Freeway
 - ↳ Arterial
 - ↳ MPO/Planning
 - ↳ Other partners
- ▶ Are there other strategies that the region should explore for ICM on US50?
- ▶ Based on what you have heard over the last 2 days, what institutional and technical challenges do you see for ICM on the US50 (or other) corridors?

US 50 ICM Capabilities

For initial deployment:

- Automatically detects congestion events
- Real-time (multimodal) decision support
- Network traffic prediction
- Real-time response strategy assessment
- Dynamic rerouting
- Freeway coordinated adaptive ramp metering
- Signal coordination with freeway ramp metering
- Regional arterial management
- En-route traveler information
- Pre-trip traveler information





US 50 System Improvements

► Freeway system improvements

- ↳ Corridor ramp metering
- ↳ Advanced central signal control
- ↳ Freeway vehicle detection (VDS, bluetooth/wifi, other sensors)

► Arterial system improvements

- ↳ Intersection control upgrades
- ↳ Arterial vehicle detection (VDS, bluetooth/wifi, other sensors)
- ↳ Trailblazer signing

► Other systems (transit, parking, active transportation, trucks)

► Integration System (DSS, data hub, interfaces)

► Traveler information systems

► Pre-planned response plans (for each scenario)

